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Before the
Federal Communications Commission
Washington D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of)

Amendment of the Commission's)
Rules to Establish New Personal)
Communications Services)

GEN Docket No. 90-314
ET Docket No. 92-100 /

To: The Commission

TABLE OF CONTENTS

Executive Summary

I.	WINForum's Spectrum Etiquette is the Product of Extensive Technical Work And A Broad-Based User-PCS Industry Consensus Process.....	2
A.	WINForum Emerged From An Informal Alliance of Manufacturers Committed To Realizing The Commission's User-PCS Goals.....	3
B.	The WINForum Spectrum Etiquette Was Developed In An Open Process Characterized By Diversity And Breadth Of Participation By The User-PCS Industry.....	4
II.	The Philosophical Basis of the WINForum Etiquette Strives To Ensure Fair And Flexible Access To User-PCS Spectrum.....	7
A.	The User-PCS Industry Requires Adequate Spectrum For Different Asynchronous And Isochronous Needs.....	8
B.	Asynchronous And Isochronous Sub-Bands Are Incorporated Into WINForum's Spectrum Etiquette.....	9
C.	WINForum's Sub-Band Segmentation Plan Allows For The Most Flexible Possible Uses and Technologies.....	10
D.	Listen-Before-Talk Is A Central Feature Of The Spectrum Etiquette.....	12
III.	WINForum's Spectrum Etiquette Satisfies The Commission's Goals.....	13
A.	The WINForum Etiquette Promotes Spectrum Efficiency Without Guard Bands.....	14
B.	The Spectrum Etiquette Allows For Cross-Over Between The Voice And Data Sub-Bands.....	15
C.	The Spectrum Etiquette Can Support Spread Spectrum Technologies.....	16
D.	The Spectrum Etiquette Should Assist Appropriate Standards Bodies Addressing Interoperability And Compatibility Between Unlicensed And Licensed PCS.....	17

IV.	Ericsson's Alternative Proposal Would Impose Undue Limitations And Costs Upon User-PCS.....	18
A.	Ericsson's Proposal Does Not Allow Any Asynchronous Data Technologies.....	18
B.	Ericsson's Proposal Would Impose Other High Costs For Data Devices.....	18
C.	In View Of Its Limitations, Ericsson's Proposal Is Ill-Suited To The Commission's Goals for User-PCS.....	20
V.	Conclusion.....	21

EXECUTIVE SUMMARY

The Wireless Information Networks Forum ("WINForum") has developed a comprehensive Spectrum Etiquette to permit fair spectrum access by the broadest possible range of unlicensed, user-provided data and voice Personal Communications Services ("User-PCS"). This proposal was prepared by an association of leading information technology companies who share the common goal of ensuring a regulatory framework that permits flexible, innovative and diverse uses of the spectrum allocated to User-PCS. The Spectrum Etiquette was prepared in an open industry forum pursuant to procedures that considered over one hundred technical contributions and involved thousands of meeting hours – not to mention additional substantial time and energy devoted to business and marketing issues. Its purpose is not to serve as a manufacturing standard, but rather to provide operational procedures that allow individual manufacturers to pursue their own visions of User-PCS.

On May 17, 1993, WINForum submitted its working draft of the Spectrum Etiquette for public comment with the expectation that "constructive criticism will improve its content and phrasing" In response to this filing, several basic questions were raised concerning WINForum and its working draft proposal:

- Many of the comments noted the incomplete status of the Spectrum Etiquette and highlighted questions that should be answered before the Commission adopted the proposal.
- A few of the comments contended that WINForum is not an open, impartial forum for developing the Spectrum Etiquette so that either the Commission or a standards body must now assume that task.
- A few of the comments questioned technical aspects of the Spectrum Etiquette related to division of the band into separate asynchronous and isochronous segments as well as the channelization within the isochronous band.
- Some comments filed by licensed PCS service interests expressed concerns about the effects of the Spectrum Etiquette upon compatibility or interoperability between licensed and unlicensed PCS.
- Ericsson offered an alternative proposal based upon isochronous technology with no spectrum reserved for asynchronous technologies.

As documented below, WINForum's development of a consensus Spectrum Etiquette has been an undertaking of considerable complexity involving the direct participation of a broad cross-section of the User-PCS manufacturing industry. WINForum has served as a catalyst for reaching compromises between differing approaches and technologies for User-PCS.

The opening comments correctly note that WINForum's May 17, 1993 submission was an unfinished working draft. WINForum submitted an updated plan on June 21, 1993, that addresses the concerns and questions identified in those comments. In addition, WINForum is conducting public briefings on the Spectrum Etiquette to answer questions concerning its origins, purposes and effects.

The Spectrum Etiquette reflects consensus judgments that necessarily involve compromises and tradeoffs. A fundamental principle governing the development of the Etiquette has been to recognize and accommodate the different needs of services requiring continuous connection-oriented, isochronous operation (typified as voice services) and bursty, connectionless asynchronous operation (typified by data services). Consistent with this approach, the Spectrum Etiquette designates one-half of the available spectrum for isochronous use in 1.25 MHz segments that can accommodate narrower-band signals while the other half of the band is designated for asynchronous uses that may range from 50 kHz to the full asynchronous sub-band segment.

The division of the band into equal asynchronous and isochronous sub-bands is essential to ensuring spectrum for different data and voice uses and technologies. A few commenting parties, however, question whether this approach will impede flexibility and efficiency due to the purported need for guard bands between sub-bands, limitations on crossing from one sub-band to the other, lack of compatibility with licensed PCS service and the segmentation plan adopted by WINForum. As documented below, however, those concerns are misplaced for several reasons:

- The Spectrum Etiquette prevents interference between sub-band users through emission limitations that avoid the need for guard bands.
- Cross-over from one sub-band to the other is permitted so long as User-PCS equipment complies with the rules of the sub-band in which it operates.

- This asynchronous and isochronous segmentation plan is a best effort to maximize opportunities for User-PCS given the insufficient amount of spectrum proposed for the allocation.
- The Spectrum Etiquette provides a set of operating rules for User-PCS that do not address or limit compatibility or interoperability with licensed PCS – issues which can be pursued through appropriate industry standards bodies.

A few commenting parties also question whether the Spectrum Etiquette can accommodate spread spectrum technologies. In such respects, WINForum's proposal is designed to ensure the maximum possible opportunities for different technologies, including spread spectrum, so long as the specific iterations of those technologies can be deployed consistent with the segmentation plan. While some broadband variations of spread spectrum cannot currently operate within 1.25 MHz isochronous segments, this is a function of tradeoffs in maximizing opportunities for all technologies rather than any lack of technological neutrality in the Spectrum Etiquette.

Ericsson, although an active member of WINForum, offers its own proposal that contemplates using the entire available spectrum for isochronous User-PCS based upon standards designed primarily for voice services. The effects of this approach, however, would be to remove any assured "home" for data services and to eliminate access to spectrum for asynchronous operations. WINForum, under its consensus policies, could not endorse such an approach that would not accommodate the needs of both data and voice User-PCS. Moreover, as detailed in these Reply Comments, Ericsson's proposal would entail other significant costs and tradeoffs unacceptable to the industry as a whole.

In view of the record now before the Commission, WINForum believes that prompt adoption of its consensus-based Spectrum Etiquette would serve the public interest. WINForum is not proposing a standard, but rather a framework within which a wealth of systems and devices based upon different standards and technologies can be deployed and co-exist without destructive interference. While standards bodies can and should address technical issues associated with compatibility between unlicensed and licensed PCS, there is no need to duplicate WINForum's efforts. The WINForum Spectrum Etiquette is an accomplishment that the Commission can and should recognize in finalizing its rules for User-PCS.

Finally, WINForum emphasizes that 40 MHz of spectrum is needed to support the near-term needs of User-PCS. A smaller allocation unduly constrains the deployment and development of new systems and devices given the inherent need to subdivide the User-PCS allocation into separate isochronous and asynchronous segments. Absent adequate spectrum, the manufacturing industry will be significantly constrained in its ability to introduce advanced products that can enhance U.S. productivity and benefit consumers.

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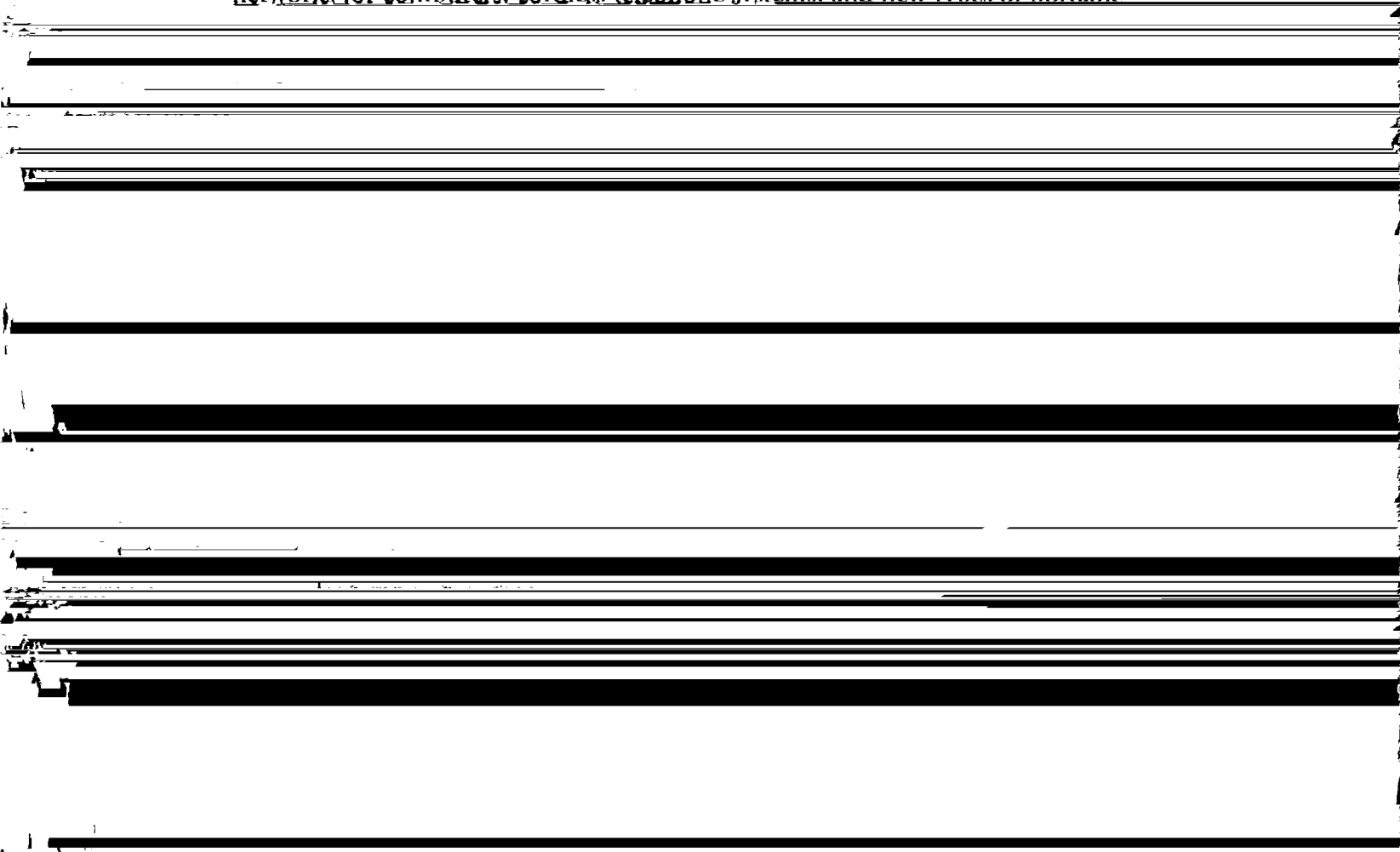
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To: The Commission

Reply Comments on the Spectrum Etiquette

The Wireless Information Networks Forum ("WINForum") is an alliance of leading information technology companies that are working together to obtain, and effectively employ, radio spectrum for unlicensed, user-provided voice and data personal communications services ("User-PCS"). These include wireless local-area networks for computers, cordless telephone systems, and new types of portable



In any pioneering industry undertaking, second-guessing is possible and sometimes fashionable. However, neither WINForum nor its members are apologetic for their timely, good faith efforts to forge broad-based User-PCS industry consensus and compromises – a responsibility that no other organization has assumed. Nor are apologies necessary for having volunteered for public comment an unfinished working draft in order to facilitate expeditious Commission action.

In fact, only one other proposal has been advanced in the one year that has passed since the Commission adopted its PCS Notice of Proposed Rulemaking. Unfortunately, this alternative submitted by Ericsson is fatally flawed by its exclusive reliance on isochronous technologies best suited for voice communications and its failure to afford any opportunities whatsoever for asynchronous technologies required for data systems and devices. Consequently, for reasons detailed below, the Commission should promptly move forward to adopt WINForum's balanced proposal that ensures access to spectrum for both data and voice needs while affording flexibility for divergent technological approaches to User-PCS.

I. WINForum's Spectrum Etiquette Is The Product Of Extensive Technical Work
And A Broad-Based User-PCS Industry Consensus Process

On May 17, 1993, WINForum submitted to the Commission its working draft of a Spectrum Etiquette in which one-half of the unlicensed PCS spectrum would be designated for isochronous uses typified as voice services with the other half for asynchronous uses typified as data services. While not then complete in all details, the draft was sufficiently mature so that public comment could help improve its elements. On June 21, 1993, WINForum filed comments updating its working draft to reflect industry consensus on several previously unresolved issues. With these revisions, WINForum believes that its Spectrum Etiquette is ready for Commission adoption.

A few commenters, however, now contend that Etiquette issues should be referred to standards bodies or special Commission processes to remedy a purported lack of openness or consensus in WINForum. These suggestions seem misplaced as WINForum emerged to address the unique problems of the User-PCS industry that other industry organizations were not prepared to pursue in a timely fashion. WINForum's openness should be evident given the participation in its processes of numerous companies with diverse interests. Nonetheless, WINForum has set forth below an overview of its formation, goals and processes to lay such claims to rest.

A. WINForum Emerged From An Informal Alliance Of Manufacturers Committed To Realizing The Commission's User-PCS Goals

In its 1992 Personal Communications Services Notice of Proposed Rulemaking,¹ the Commission proposed allocating spectrum for new unlicensed PCS. The Notice sought to "foster the rapid introduction of new PCS technologies by permitting manufacturers to experiment with, and directly market to the general public, products using new designs and technologies, without the delays associated with the licensing of a radio service."² With the need for licensing and attendant delay removed, consumers would have access to a diverse array of low power, highly portable and mobile wireless data, voice and messaging devices and systems whose forms are only now beginning to take shape.³

In anticipation of the Commission's initiative, several leading information technology companies began meeting regularly in August 1991 to seek constructive approaches to achieving a regulatory framework that permits flexible, innovative, and varied uses of User-PCS spectrum. They were responding to the recognition by the FCC and manufacturers that the allocation of spectrum for User-PCS would require development of an equitable mechanism for coexistence within those frequencies.

As a result of those discussions, an alliance of large and small computer and communications companies was publicly announced in June 1992. The alliance "called on the Federal Communications Commission . . . to allocate radio frequencies to" User-PCS and urged that the "regulatory framework for user-provided PCS . . . provide for maximum possible flexibility in design and implementation while providing users fair access to the spectrum."⁴

¹ Amendment of Commission's Rules to Establish New Personal Communications Services, GEN Docket 90-314, 7 FCC Rcd 5676 (1992) (Notice of Proposed Rulemaking) [hereinafter "PCS NPRM"].

² PCS NPRM at 5693.

³ In the related Emerging Technologies proceeding, the Commission reinforced this commitment to making spectrum available to accommodate a diversity of new capabilities "as the technology advances and these services become feasible." Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies, ET Docket No. 92-9 (First Report and Order and Third Notice of Proposed Rulemaking), 7 FCC Rcd 6886 (1992). The agency emphasized its desire to allow manufacturers a high degree of flexibility in bringing products and services to the market, specifically declining to "predefine all services and specific technologies that might operate in these bands" for fear that this "would defeat [the] goal of conserving suitable spectrum to foster development of new technologies that will allow U.S. industry to move quickly and keep pace with telecommunications developments throughout the world." *Id.* at 6893.

⁴ News Release, WINForum (June 8, 1992).

Immediately upon adoption of the FCC's Notice of Proposed Rulemaking, WINForum met formally in July 1992 to form its Technical Committee and established a schedule calling for Technical Committee meetings twice each month through the end of that year. WINForum's formation, goals and developmental activities were publicized in more than 30 domestic and international industry publications over the past year. As a result, a broad range of data and voice manufacturers joined the alliance.

B. The WINForum Spectrum Etiquette Was Developed In An Open Process Characterized By Diversity And Breadth Of Participation By The User-PCS Industry

A guiding principle of WINForum's Spectrum Etiquette development process has been the goal of recognizing and accommodating the substantially different needs of services that may roughly be classified as isochronous (typically considered voice services) and asynchronous (typically considered data services) in a manner that maximizes efficiencies and opportunities for all User-PCS providers. The monumental difficulties inherent in this task were compounded by the insufficient amount of spectrum proposed to be made available.

Notwithstanding this formidable challenge, WINForum established a goal of developing a mechanism that would optimize achievement of different and sometimes competing objectives:

- Allow users to share spectrum for various voice and data systems and devices;
- Promote fair access to the spectrum for all users;
- Maximize spectral efficiency in a sharing environment;
- Permit all providers to use fully the allocated spectrum;
- Allow for allocation of additional spectrum for deployment of unlicensed technologies consistent with FCC requirements;
- Promote cost-effective implementation of new technologies; and
- Maintain regulatory flexibility to promote and encourage product innovation.

Most importantly, WINForum and its members viewed their Spectrum Etiquette work as an input to the FCC's ongoing rulemaking proceedings to establish User-PCS. It was not intended to serve as a formal traditional standard, but merely a minimal framework to provide for the coexistence of devices and systems predicated on varying technologies, produced by multiple manufacturers, and delivering many different types of service capabilities. As such, WINForum has always expected that the Spectrum Etiquette would not only be subject to full public analysis and comment, but would likely be improved by undergoing such a review.⁵

Throughout 1992, WINForum had no formal membership eligibility requirements and was effectively open to all who shared the vision of ensuring fair and flexible spectrum access. In particular, User-PCS was seen as a means to allow unlicensed and trouble free purchase and use of devices and systems. Consistent with the Commission's Notice of Proposed Rulemaking, this allocation would support customer-owned equipment with no air time fees.

Late in that year, as a result of legislative developments affecting User-PCS, the WINForum participants determined that a more formalized structure would be necessary to effectively advocate the allocation of spectrum to and deployment of User-PCS systems and devices. Thus, concomitantly with its ongoing technical meetings, which have continued throughout 1993 both in-person and via electronic conferencing, the WINForum participants undertook the additional time-consuming task of creating and funding a formal trade association for User-PCS manufacturers.

The incorporation of that association in April 1993 required the formalization of membership criteria. Central to those recently adopted criteria is a commitment to the successful deployment of User-PCS systems and devices characterized by customer-owned equipment and no air time charges. WINForum has notified all entities inquiring about membership opportunities of these criteria and, to date, no entity has been denied membership.⁶

⁵ See, e.g. WINForum Spectrum Etiquette, GEN Docket No. 90-314, ET Docket No. 92-9 (filed May 17, 1993) at 3. Indeed, in an effort to accommodate the FCC's tight time schedules, WINForum submitted a working draft of the Etiquette so as not to unduly delay the process.

⁶ Delays in processing applications and inquiries can be attributed to these developments. See Omnipoint Comments at 4. Omnipoint turned down an earlier solicitation for its participation in the ad hoc WINForum group, and it is now a member of the trade association.

Notwithstanding its ambitious work program, WINForum has consistently engaged in outreach to other interested parties. At the invitation of Telocator, ECSA/T1, and TIA, WINForum provided an in-depth presentation at the opening plenary of the Joint Experts meeting for PCS Air Interfaces (November 1992). Subsequently, WINForum presented a comprehensive seminar on its Etiquette philosophy and work product before the Telecommunications Industry Association's Personal Communications Services Conference. Additional presentations were recently made to the Joint Technical Committee and TIA jointly in late June 1993 and to Telocator in early July. The computer industry's largest networking conference, Interop, will host another WINForum panel next month. Further, public briefings on the Spectrum Etiquette are anticipated to answer questions that have been raised concerning its origins, purposes, and effects.

Today, in recognition of its important efforts, WINForum includes virtually all of the major and many smaller communications and information technology manufacturing companies. Numerous professionals representing these companies devoted tens of thousands of man-hours in meetings and the preparation of more than 100 technical papers addressing the many technically complex and difficult issues, as well as business and marketing concerns, presented by User-PCS.⁷ This has been an unprecedented voluntary and consensus-based attempt to realize the vision of providing the public with numerous, diverse User-PCS technologies and applications.⁸

In fact, the decisionmaking procedures implemented by WINForum ensured that participants received full consideration and different points of view were presented in the process. Upon identification of an issue or proposed solution to an outstanding issue by a WINForum member, a technical contribution was prepared and submitted

7	<u>Etiquette Technical Papers by Topic</u>	<u>Number</u>
	Simulations/Propagation/Generic Technical Issues	29
	Spectrum Sharing Issues	7
	Isochronous Transmission Issues	26
	Asynchronous Transmission Issues	9
	Work/Task Group Reports/Recommendations	37
	Outside Input	9
	(as of June 2, 1993)	

⁸ The number and significance of the technical and other compromises that went into the Etiquette – which are discussed in other sections of these comments – illustrate the variety of inputs that were considered and the diversity of interests that were accommodated in reaching the requisite industry consensus.

to the WINForum Technical Committee. The contribution would then be presented and debated in an open forum within the Technical Committee. If, at that stage, the members were able to reach consensus on the subject, the Committee was tasked to create a recommendation for inclusion in the Etiquette. If consensus was not achieved after discussion, the matter could be assigned to a standing working group,⁹ an ad hoc group,¹⁰ or an in-meeting task group. The delegated group would then prepare a new technical contribution, which would again be circulated through the Technical Committee for debate and evaluation. This cycle would be repeated until consensus was reached and a recommendation created for the Etiquette.

All such recommendations would be submitted to the Technical Committee for approval, which required a two-thirds vote of companies following ANSI quorum

etiquette should not unduly constrain product innovation. Rather, the member companies of WINForum are interested only in ensuring fair "ground rules" that allow devices from different manufacturers to coexist in an interference-limited environment and then allow the marketplace to determine the successful products.

The Etiquette has not been designed to replicate an equipment standard. Equipment standards establish tight design specifications to permit interoperability between similar systems manufactured by different vendors. In contrast, the WINForum Etiquette recognizes the Commission's desire to accommodate a broad range of PCS devices in this spectrum¹¹ and thus establishes a set of behavioral rules to permit non-intrusive sharing in a common frequency band.

This approach is essential in removing any "handcuffs" from engineers and designers who will strive to develop equipment to meet the unmet demand for User-PCS products. WINForum recognizes that manufacturers may need to modify designs to some extent in order to satisfy the Commission's requirements for fair spectrum access.

For the past year, the WINForum membership has invested thousands of man hours pursuing this vision. Significant and detailed technical papers addressing the technical bases for the Etiquette were submitted by dozens of companies for peer review within the WINForum process. It is the near-unanimous position of the companies participating in WINForum that the above stated objectives have been satisfied to the greatest extent possible by the revised WINForum Etiquette, given the severe constraints imposed by the proposed allocation of insufficient spectrum.

A. The User-PCS Industry Requires Adequate Spectrum For Different Asynchronous And Isochronous Needs

WINForum has come to recognize that there are technical and marketplace needs for both asynchronous and isochronous User-PCS systems and devices. Because of their markedly different characteristics, non-interfering coexistence of these different transmission technologies requires separate spectrum bands. Briefly, these differences, and similarities may be summarized as follows:

¹¹ PCS NPRM at ¶694.

Isochronous

- Good for voice, low-speed data
- Poor choice for high-speed, bursty data
- Cannot coexist with asynchronous
- Can be coordinated for early deployment
- Must have clear spectrum for universal deployment
- 20 MHz needed (office density)

Asynchronous

- Good for high-speed data applications
- Poor choice for most voice applications
- Cannot coexist with isochronous
- Can be coordinated for early deployment
- Must have clear spectrum for universal deployment
- 20 MHz needed (office density)

WINForum also believes that two separate allocations, each at least 20 MHz, are required to meet even the near term needs for both isochronous and asynchronous systems.¹² WINForum, on behalf of both the telephony and computer elements of its membership, believes it is in the public interest that both services be provided adequate spectrum allocations. These allocations should be symmetrical and should accommodate both early deployment and universal deployment through rules that provide for a clearing of the allocated bands. Assuming that more spectrum is forthcoming, the applicable elements of the Spectrum Etiquette could potentially be separated into two simpler and more concise plans to which the needed spectral mask and adjacent channel interference provisions could be added.

B. Asynchronous And Isochronous Sub-Bands Are Incorporated Into WINForum's Spectrum Etiquette

WINForum has spent considerable time and effort trying to balance the divergent needs of asynchronous and isochronous systems within a limited spectrum. As one would expect, the operational characteristics of the two types of devices are quite different. Isochronous transmitters, which are commonly used for voice applications, generally occupy a spectrum "link" for relatively long periods of time and have some flexibility in the time required to gain access to a link (up to one second). Asynchronous transmitters, which are generally used for data applications, generally need to begin transmissions within milliseconds but release the spectrum link very quickly.

¹² For example, the two allocations could come from the 1900-1920 MHz and 1920-1940 MHz bands. Through such an allocation, each category would be required to deal with the same approximate number of fixed microwave incumbents as the other and, therefore, neither would gain any advantage in early deployment due to an unlevel playing field.

Asynchronous devices also tend to require more spectrum than isochronous systems. One of WINForum's primary goals was to ensure that wideband, high speed data applications employing asynchronous transmitters were accommodated within this allocation. If such devices must share spectrum with numerous narrowband voice devices, which tend to hold their spectrum links for relatively long periods of time, the probability of finding sufficient quantities of clear spectrum necessary for asynchronous uses is significantly reduced. After much deliberation, WINForum ultimately decided to separate isochronous and asynchronous devices within the proposed User-PCS allocation.

WINForum certainly recognizes that its proposal is a compromise of various considerations and that alternatives do exist. For example, one alternative is to preclude wideband asynchronous transmitters from this allocation.¹³ Although WINForum strongly supports the notion of additional spectrum allocations to better accommodate all User-PCS devices, it strongly disagrees with any proposal to bar wideband data devices from the spectrum altogether. Such a suggestion is antithetical to the Commission's desire that this allocation serve a broad range of unlicensed PCS devices.¹⁴

Furthermore, the industry believes that there is an extraordinary unmet demand for consumer-quality wireless applications. Waiting for additional spectrum allocations though new rulemakings will take years, leaving this demand unsatisfied. The public interest demands that all potential applications, including wideband devices, be accommodated in the spectrum allocated in this present proceeding.

C. WINForum's Sub-Band Segmentation Plan Allows For The Most Flexible Possible Uses And Technologies

The WINForum Etiquette divides the isochronous sub-band into 1.25 MHz segments.¹⁵ This segmentation plan was chosen after reviewing the various technologies and access schemes expected to be deployed in the User-PCS spectrum. The Etiquette does not segment the asynchronous sub-band in order to allow for

¹³ Comments of Ericsson, Appendix C at 3 and 3, footnote 1.

¹⁴ PCS NPRM at ¶694.

¹⁵ It is not entirely correct in a technical sense to call these segments channels. The Etiquette does not specify center frequencies of these band segments and, thus, manufacturers are provided flexibility to develop technologies that concentrate energy anywhere within the 1.25 MHz segments.

devices that utilize most or all of such available spectrum for wideband data applications. The ability of asynchronous data transmissions to occupy a link only for short periods of time coupled with the requirement to monitor before transmissions will, in large measure, provide such devices with sufficient interference protection.

In considering isochronous devices that intend to serve voice applications, however, WINForum recognized that most devices to be introduced into this spectrum would be based on some form of frequency division multiple access (FDMA) or time division multiple access (TDMA) or spread spectrum technology such as CDMA. In addition, providing for duplex operations requires either frequency division duplex (FDD) techniques, where the forward and reverse channel path are separated by frequency, or time division duplex (TDD) where the forward and reverse paths occupy the same frequency at different times. Thus, the segmentation plan for isochronous devices was designed, at a minimum, to accommodate each of these technologies. In addition, the proposed segmentation plan was designed to promote an optimal reuse of the available spectrum while, at the same time, ensuring that sufficient alternative links exist to avoid interference effects.

Obviously, the available spectrum can only be evenly segmented in so many ways. Ultimately, it was decided to divide the sub-band into 1.25 MHz blocks. This plan is supported by the fact that, for example, even considering only a 20 MHz User-PCS allocation, under an $n=4$ frequency reuse plan, each cell has four alternate links at its disposal. In addition, under an $n=7$ frequency reuse, each cell has at least one alternate link. Thus, this segmentation satisfies the dual requirement of fostering frequency reuse while ensuring that alternative routes are available for users.

The 1.25 MHz plan also was chosen because of its ready adaptability by a variety of technologies including spread spectrum. WINForum is aware of at least one manufacturer that provides spread spectrum technology that is based on 1.25 MHz channels. Once again, the WINForum Spectrum Etiquette was designed to allow for a multiplicity of technologies from a variety of vendors.

No other frequency usage plan satisfies the many objectives under such severe spectrum constraints. Larger channel blocks would result in less alternative link capability. In fact, segmenting the proposed allocation into blocks larger than 1.25 MHz provides no alternative capacity capability under an $n=7$ reuse plan. Smaller sized blocks do provide for greater frequency reuse, but do not accommodate any

spread spectrum technology. For these reasons, WINForum recommends that the Commission adopt its proposed segmentation plan contained within the Spectrum Etiquette.

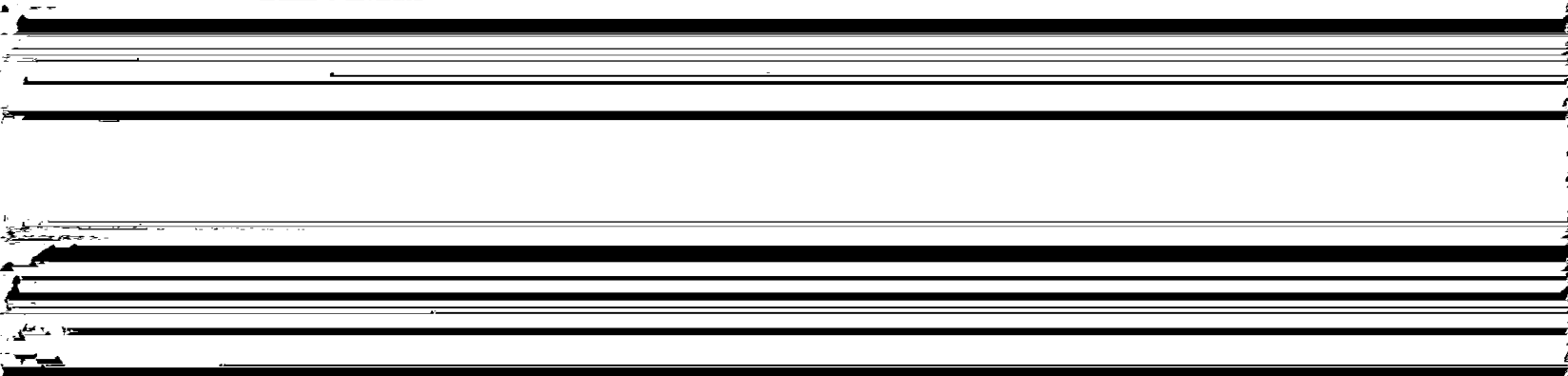
D. Listen-Before-Talk Is A Central Feature Of The Spectrum Etiquette

The key to success for User-PCS devices is to provide users with high quality service. Simply put, the industry will not long survive if the products offered to the public suffer from a high degree of interference.

In order to achieve a high quality of service, the Spectrum Etiquette requires that all devices must "listen" before they "talk." WINForum's Etiquette specifically proposes that each device be able to monitor the relevant frequency band and detect that there is an absence of threshold energy on the particular channel prior to commencing transmissions. WINForum recommends that the Commission enforce such capabilities through its equipment authorization process.

The listen before talk requirement would operate differently in the isochronous and asynchronous sub-bands. Isochronous devices (i.e., voice devices) would be required to monitor their sub-band for at least the maximum frame time in order to verify that there is no detectable energy above the specified threshold. Monitoring occurs at the beginning of the conversation and further monitoring would be unnecessary once access to a channel is achieved. In addition, the Etiquette contains provisions for voice services requiring different amounts of spectrum to begin their search for available spectrum at different ends of the band. This results in more efficient spectrum use by ensuring that the band does not become "fragmented."

Monitoring requirements for asynchronous devices, on the other hand, would be dependent upon the transmission rate of the individual device. For example, a high



Each of these technical criteria of the Etiquette attempts to support the fundamental goal of satisfying a variety of technologies in a limited amount of spectrum. Representatives from the world's leading technology companies sat down and attempted what some considered impossible. The resulting Etiquette, if adopted, will involve costs and tradeoffs for all concerned. WINForum firmly believes, however, that the costs imposed to the entire industry will be held to a minimum through the adoption of its Spectrum Etiquette.

III. WINForum's Spectrum Etiquette Satisfies The Commission's Goals

During its deliberations, WINForum strived to balance a variety of interests in order to facilitate the introduction of as many technologies and devices as possible in the User-PCS spectrum. WINForum's primary goal of promoting the efficient use of this spectrum in a shared environment was, however, substantially complicated by the numerous issues presented. Specifically, the demands imposed by an insufficient allocation of spectrum, accommodation of isochronous and asynchronous transmissions, ensuring fair access to available spectrum, creating a flexible end product that would permit coexistence of different technologies, remaining neutral with respect to such differing technologies, and reaching an industry-wide consensus as to all of these issues entailed numerous compromises and tradeoffs. WINForum submits that its Spectrum Etiquette successfully realizes its goal in light of these considerations.

Some comments concerning the original working draft Etiquette nonetheless offered critiques of certain aspects of the technical specifications of the Etiquette. In particular, four basic concerns were advanced, namely that segregating voice and data systems necessitates the use of guard bands which will reduce spectrum efficiency; that the Etiquette does not foster technologies that "cross-over" into the other sub-band when additional capacity is needed; that the Etiquette's channeling plan is incompatible with spread spectrum technologies; and that the Etiquette does not address compatibility and interoperability between unlicensed and licensed PCS.

It is WINForum's considered opinion that these criticisms are either exaggerations of the problem or have been adequately addressed by the revised and completed Spectrum Etiquette that was submitted in comments.

In particular, WINForum believes that its recommended emissions limitations will prove more flexible and efficient than guard bands in effectively controlling interference to adjacent frequency operations. Also, the revised Etiquette does contain

provisions that allow certain devices to cross over the band demarcation in order to borrow spectrum from the more lightly used sub-band. WINForum also notes that spread spectrum technologies are not prohibited by the Etiquette and that, with certain limitations, all technologies can succeed in the User-PCS band. Finally, the Spectrum Etiquette does not address or limit compatibility with licensed PCS and such issues should be pursued through formal standards bodies. Each of these issues is further addressed below.

A. The WINForum Etiquette Promotes Spectrum Efficiency Without Guard Bands

Some commenters argue that dividing the User-PCS spectrum requires guard bands to prevent interference between a device operating immediately adjacent in frequency to the sub-band demarcation and in close physical proximity to a device operating in the other sub-band. The implication, however, is that guard bands reduce the amount of usable spectrum in an allocation that most concede is already too small and thus promotes spectrum inefficiency.¹⁶

Clearly, this issue is not unique to User-PCS. Whenever spectrum is made available to multiple users, some regulatory controls such as guard bands and/or emission limitations must be imposed to avoid interference to neighboring systems. These controls will always reduce overall information throughput capabilities of the spectrum, which is but one measure of spectrum efficiency. This is the price one pays, however, in allowing a diversity of technologies and users to share the same spectrum. In WINForum's view, it is an appropriate price to pay given the apparent diversity of ideas waiting to develop in the User-PCS spectrum.

In its revised Etiquette, WINForum establishes transmit power emissions limits to minimize the out of channel emissions rather than establishing guard bands to limit interference between systems operating in the two sub-bands.¹⁷ Specifically, Section 2.3.2 of the revised Etiquette sets inter sub-band emissions levels for intentional radiators operating in the first, second, third and subsequent 1.25 MHz frequency segments adjacent to the inter sub-band edges.¹⁸ In this manner, the WINForum solution avoids the spectrum inefficiencies of guard bands.

¹⁶ Comments of Ericsson at 12.

¹⁷ Comments of WINForum at 10.

¹⁸ *Id.* at 10.

In addition, WINForum notes that its inter-band emission limitations will also result in attenuated emissions beyond the User-PCS allocation. In particular, WINForum notes the existence of fixed microwave receivers located within the 1850-1990 MHz band and the need to provide interference protection to such operations. Also, WINForum notes that this issue is currently being addressed by the TIA in the redrafting of Bulletin 10 F which is analyzing the protection criteria to fixed microwave services. Many of WINForum's members are participating in those deliberations.

Obviously, the Spectrum Etiquette's emission limitations also attenuate potential interference to future, licensed PCS systems in adjoining spectrum. While WINForum has not attempted to address such concerns, the low-level emissions under the emission mask and power levels should not cause out of band interference problems. Nonetheless, WINForum believes that the legitimate and important concerns of licensed PCS interests can and should be addressed through appropriate standards bodies or the FCC. In such respects, the Spectrum Etiquette does not preclude any additional emission mask or interference safeguards found to be necessary.

B. The Spectrum Etiquette Allows For Cross-Over Between The Voice And Data Sub-Bands

The ability to cross-over from one sub-band to the other has been added to the Etiquette to provide for flexible use of the User-PCS band.¹⁹ A criticism of the original Etiquette has been that the subdivided spectrum design lacked a cross-over method to permit sharing of the whole spectrum depending on the level of demand for voice and data at a particular location.²⁰

The revised Etiquette addresses this concern by adding a cross-over solution. This new rule simply requires that the "crossing" service comply with the Etiquette rules established for that sub-band. For example, if a particular User-PCS site has significant data requirements and less voice demands, data transmissions may overflow into the isochronous sub-band but must follow the isochronous Etiquette rules. In effect the Etiquette requires those users wishing to take advantage of both sides of the

¹⁹ Comments of WINForum at 12.

²⁰ Comments of Ericsson at 6.

User-PCS spectrum to be equipped with devices which are able to operate both asynchronously and isochronously.

WINForum recognizes the reality that the utility of this provision may be somewhat limited due to the added manufacturing expense of building two types of radios into a single device. In addition to cost, it also requires users to accept lesser grades of performance by requiring their devices to operate in ways that are not well suited for the particular application. WINForum notes that this appears to be the unfortunate reality of asynchronous and isochronous devices and that its best efforts were unable to devise a simple scheme to increase access of all devices to the entire allocation. While WINForum expects that advances in technology may ultimately improve the utility of the cross-over mechanism, WINForum believes that the real solution lies in the allocation of additional spectrum to satisfy existing and future needs of asynchronous and isochronous systems and devices.

C. The Spectrum Etiquette Can Support Spread Spectrum Technologies

Some commenters express concern that the Etiquette's segmentation of the isochronous sub-band into 1.25 MHz blocks would preclude the use of spread spectrum devices.²¹ As such, these commenters imply that the WINForum Etiquette is overly restrictive and discourages technical flexibility.

In response, WINForum notes that there is no underlying intent within the Etiquette to preclude any technology, including spread spectrum systems. To the contrary, one of WINForum's fundamental goals was to ensure fair access to all forms of devices. Therefore, spread spectrum technologies were given every consideration to operate in the User-PCS spectrum and, most importantly, are not precluded by the Etiquette. Indeed, such technologies may freely access the asynchronous sub-band.

The goal of ensuring fair access to a variety of devices, however, led WINForum to segment the isochronous sub-band into 1.25 MHz blocks in order to facilitate adequate re-use capabilities. This decision apparently rendered some spread spectrum voice systems that require more than 1.25 MHz to operate incompatible with the Etiquette.²² While this action is regrettable, WINForum believes it to be an

²¹ Comments of Omnipoint at 3; Comments of Ericsson at 16.

²² WINForum never received any contribution or proposal from any manufacturer or proponent of a wideband spread spectrum system that demonstrated how its equipment could operate in the User-PCS band

unavoidable consequence of a limited spectrum allocation.

WINForum emphasizes that spread spectrum technologies are not restricted by the Etiquette so long as they conform to the necessary segmentation requirements. WINForum understands that some manufacturers have developed spread spectrum technology based on 1.25 MHz segments and would thus appear to be compatible with operations in the asynchronous band.²³ If there are any other provisions within the Etiquette that inadvertently limit the abilities of spread spectrum technologies from operating in this spectrum, WINForum would work with the Commission to explore the necessary modifications consistent with the fundamental concept of fair access.

D. The Spectrum Etiquette Should Assist Appropriate Standards Bodies Addressing Interoperability And Compatibility Between Unlicensed And Licensed PCS

As noted earlier, the WINForum Spectrum Etiquette is not a standard but a set of operating ground rules under which standards may be deployed. Moreover, WINForum's focus has been on ensuring fair access and non-interfering operations within the allocated User-PCS spectrum. We understand the interest that several manufacturers have in producing devices that will operate in both the unlicensed and licensed PCS spectrum. WINForum's Spectrum Etiquette does not preclude interoperability or compatibility between unlicensed and licensed PCS. This is confirmed by the several participating companies who have products under development targeted at operating in both PCS bands.

WINForum believes that its proposed Spectrum Etiquette will greatly assist standards bodies addressing licensed PCS.²⁴ For this reason, we look forward to working with any licensed PCS standards group seeking to build air interface standards upon the platform that the Etiquette provides.

without interfering with other types of devices and thus precluding those systems from fair access to this spectrum.

²³ For example, Qualcomm, Inc.'s CDMA technology operates over paired 1.25 MHz channels.

²⁴ WINForum agrees with the position of TIA's TR46.3 Working Group on Air Interfaces (JTC/Air) which declares that: "When operating in the unlicensed band, a wireless terminal needs to comply to the applicable FCC rules including the etiquette specified for use in the unlicensed PCS band. (This does not imply an etiquette between the licensed and unlicensed PCS bands)." Official meeting minutes of the April 28-29, 1993 JTC/Air meeting. JTC(AIR)/93.05.10-139. This position, taken by the TIA working group in its April 1993 meeting, is a core principle of the Etiquette endorsed by WINForum in July 1992.

IV. Ericsson's Alternative Proposal Would Impose Undue Limitations And Costs Upon User-PCS

A. Ericsson's Proposal Does Not Allow Any Asynchronous Data Technologies

In its comments, Ericsson proposes an alternative to WINForum Etiquette. Upon review of this proposal, the Ericsson's plan is clearly optimized for voice services while imposing undue limitations and costs upon data systems. Indeed, the Ericsson proposal fails to satisfy the goals of the FCC to accommodate a diversity of products within this allocation.²⁵

As shown above in Section II, voice and data services have different spectral needs. The member companies of WINForum fully believe that the needs of the local area and wide area network users require the high speed, high throughput capabilities offered by asynchronous transmitters.

Ericsson, however, would eliminate any spectrum "home" for data services and instead require all data systems and devices to share with isochronous voice systems and devices. Because of the spectrum occupancy nature of voice services, WINForum believes that voice operations would effectively block data access to the spectrum for long periods of time. Should this prove to be reality, data operations would likely forego the use of this band in search of other means. This in turn could devastate the functionality of the band itself as it is imperative that data community share the task of helping to clear the allocated spectrum. To expect that the data community would participate in the costs of clearing of incumbent users without the assurance of reasonable access to spectrum in a manner that fully satisfies their needs is unrealistic.

B. Ericsson's Proposal Would Impose Other High Costs For Data Devices

Ericsson's alternative would also impose other high costs on data User-PCS. Most notably, it would require continuous monitoring by all data devices which would significantly affect battery life and size. It would also increase greatly link set-up times for data transmissions and require data devices to occupy the spectrum for far greater periods of time than actually necessary. Finally, it would preclude asynchronous data transmissions.

²⁵ Ericsson's proposal is to only allow isochronous transmissions. Asynchronous data devices would be entirely precluded.